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Searching for keV-sterile neutrinos with KATRIN

The KATRIN (Karlsruhe Tritium Neutrino) experiment investigates the kinematic endpoint of the tritium beta-decay spectrum to determine the effective mass of the electron anti-neutrino. The collaboration reported its first neutrino mass result in fall 2019: m_ν <1.1~eV (90\% CL). Its unprecedented tritium source luminosity and spectroscopic quality make it a unique instrument to also search for physics beyond the standard model such as eV to keV sterile neutrinos.

The TRISTAN project aims at detecting a keV-sterile neutrino signature by measuring the entire tritium beta-decay spectrum with an upgraded KATRIN system. One of the greatest challenges is to handle the high signal rates generated by the strong activity of the KATRIN tritium source while keeping a good energy resolution and stability over time. Therefore, a novel multi-pixel silicon drift detector and read-out are being designed to handle rates up to 100 Mcps with an energy resolution of 300~eV (FWHM) at 20~keV.

The KATRIN experiment and its latest results will first be introduced. Then the status of the TRISTAN integration and the commissioning of the first module will be presented. And finally the challenge of modeling the tritium spectrum to extract a limit on the existence of a keV-sterile neutrino will be discussed.

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